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bcc

Subject EPACT gasoline/ethanol emission studies - meeting with NREL

EPAct Program _1-8-2008 EPA-DOE Collaboration.ppt

This e-mail summarizes the status of the EPACT test program with 16 fuels (or 19 or 29 fuels in the expanded version) with 19 vehicles with E0, E10, E15 as a result of the meeting today with Doug Lawson and Wendy Clark of NREL. Carl Scarbro is one of the main people working on this program and, at times, Marion Hoyer and I provide input. Besides Carl and me, others at the meeting were John Koupal, Paul Machiele, Tony Fernandez, Rafal Sobotowski (who has the lead for this work), and Mike Christianson. Joe McDonald also participated in some of the meeting.

Attached is a presentation summarizing the program. This work will be done by Kevin Whitney at SwRI who is also doing the DOE NREL testing on effects of lube oil on PM for LDGV.

Phase 1 of the program would be the 75 degree testing to be completed by in the coming several months (by April 30th) so results can be used for the RFS 2 regulation with the 50 degree testing to be done soon thereafter (by July 30th). Bill Charmley is to call SwRI emphasizing the priority of this program and the need to meet the schedule. **The overheads show what is in the initial program plus the DOE add-on which will include more fuels with higher ethanol content, mostly 15-20% but one E85 fuel). DOE now regards E85 work as lower in priority with the advent of E15-E20 gasolines.** Of interest is the effect of adding 15-20% of the fuel distillation curve showing increases in the fuel evaporated at lower temperatures up to the 50% point which could affect emissions.

Of interest to us is the fact that some of the DOE $2,000,000 funding will be used to obtain speciation for PM (actually a combined SVOC/PM sample) for some (a limited number) of the samples which, due to small PM sample quantities, will be combined across several driving cycles and vehicles. Joe McDonald mentioned the possible in-house program to obtain PM speciation data (a briefing for Chet on a proposed program is scheduled soon). Despite concerns about gasoline PM speciation with the SwRI dilution tunnel having some problems (due to losses on the tunnel walls) which could affect the PM profile, it was agreed that having PM speciation data would be useful.

There was a discussion of obtaining data at 50 degrees where the same gasolines could be used versus lower temperatures (20 degrees) which would require different gasoline composition. There was also a discussion of oil break-in periods (as well as a general discussion of the contribution of oil to gasoline PM and how ethanol might affect/increase it).

There was a discussion on having a high emitting vehicle (funded in the DOE portion) with induced malfunctions (catalyst removed or oxygen sensor disabled). There was also a brief discussion of a future lean-burn technology and its fuel economy benefits. Such technology may require lower sulfur gasolines. There was a discussion on how to obtain the specially blended gasolines.

There will be an updated Work Statement reflecting some of the changes agreed to (like the PM speciation) with separate funding/contract paper work for the rest of the expanded program to be done separately.

As an aside, Doug Lawson asked me beforehand to meet with him to discuss what I see as future work areas for a short plan he is putting together for James Eberhardt of DOE to have for when Congress asks for energy/emission programs it could fund. I talked to John Koupal, Paul Machiele, and Chad Bailey (and tried talking to others) to get input. What I suggested is more fuels work with nonroad engines for gasoline and diesel. Such work should could include studies on locomotive and C-3 marine. Also, biofuels work (influence of fuels on diesel after treatment) was another topic. Emissions at cold temperatures (20 degrees) was another topic (which could be increasingly important for catalytic diesel PM traps in the same way that such emissions became more important with the introduction of catalysts where the emission reductions obtained at 70 degrees were not obtained at lower temperatures due to increased time for warm-up compared to non-catalytic systems). Measuring emissions under malfunction conditions was also suggested.

Expanded EPAct Program

EPA/DOE Collaboration

January 8, 2008

Base EPAct Program

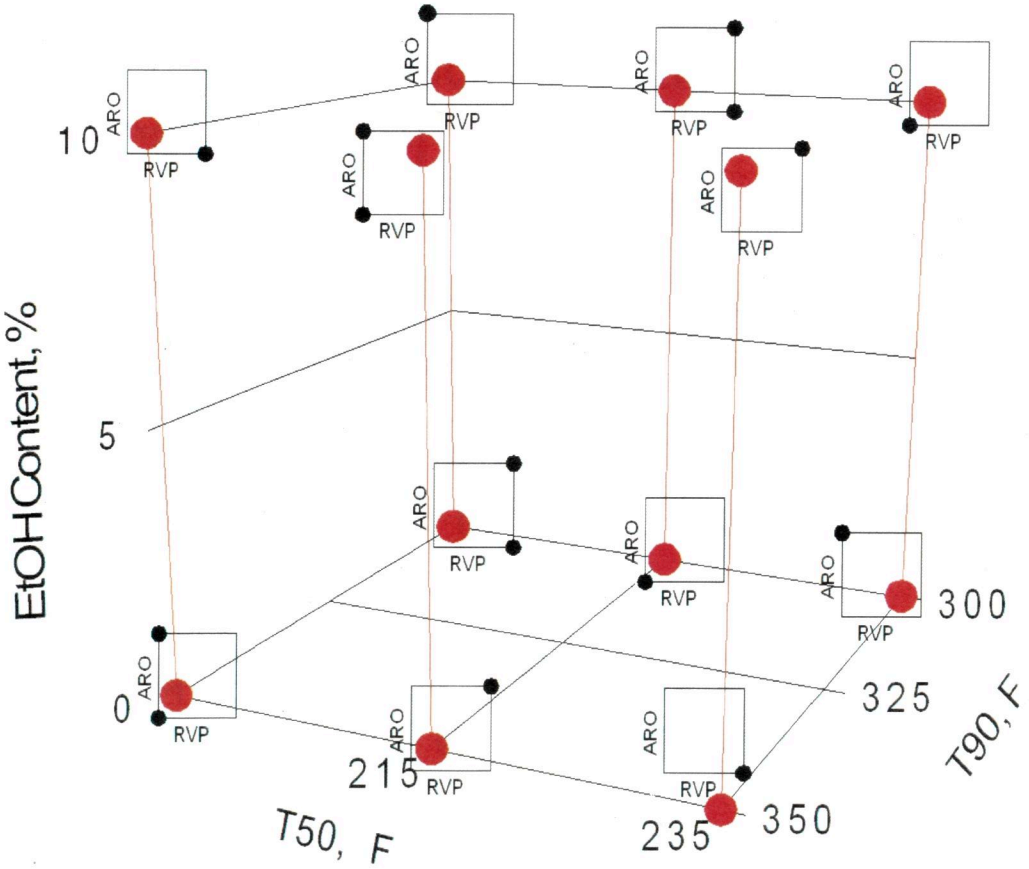
Base EPAct Program

- Objective: Establish effects of RVP,T50,T90, aromatic content and EtOH on exhaust emissions from Tier 2 vehicles
- 16 fuels, 19 vehicles in main program
- "GHG Pilot" to precede main program
  - E0, E10, E15 fuels tested in all 19 vehicles at 75°F and 50°F
  - Test results to feed into RFS 2 NPRM
- Parameters measured: Regulated emissions, CO_2, NO_2, VOCs, ethanol, carbonyls
  - Also N_2O, NH_3 and HCN by FTIR
  - No PM speciation
- 5 U.S.C. § 552(b)(5) Deliberative / Non-Responsive
  - Discussions underway with SWRI to reduce program cost

Base Fuel Matrix

5 variables, 3x2x2x2x2, 16 fuels (+3 GHG fuels)

RVP range: 7-9 psi; Aromatic content range: 15 – 40%



Base Fuel Matrix (Cont'd)

- Computer generated optimal design
- Fuel variables:
  - T50 (3 levels)
  - T90 (2 levels)
  - EtOH (2 levels)
  - RVP (2 levels)
  - Aromatics (2 levels)
- Terms in model: Main effects, $T50^2$, T50*EtOH, T90*EtOH, RVP*EtOH, aromatics* EtOH
- Number of test fuels: 16 (+3 GHG fuels)
- G-Efficiency: 83.6%

Base Fuel Matrix (Cont'd)

PROPERTY	UNIT	METHOD	BLENDING TOLERANCE	TEST FUELS									
				1	2	3	4	5	6	7	8	9	10
Relative Density, 60/60°F	-	D4052	NA	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
API Gravity, 60°F	°API	D4052	NA	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Ethanol Content	**vol. %**	**D5599**	**E0: < 0.1; E10: ± 0.5; E15: ± 0.5; E20: ±0.5; E85: ±2**	**0**	**0**	**10**	**0**	**0**	**10**	**0**	**10**	**10**	**0**
Total Content of Oxygenates Other than Ethanol	vol. %	D5599	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
T10	°F	D86	± 10	140	140	140	140	140	140	140	140	140	140
T50	**°F**	**D86**	**± 4**	**195**	**195**	**195**	**195**	**195**	**195**	**215**	**215**	**215**	**215**
T90	**°F**	**D86**	**± 5**	**300**	**300**	**300**	**350**	**350**	**350**	**300**	**300**	**300**	**350**
FBP	°F	D86	-	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437
DVPE	**psi**	**D5191**	**± 0.15**	**9.0**	**9.0**	**6.65**	**6.65**	**6.65**	**9.0**	**6.65**	**9.0**	**9.0**	**9.0**
Aromatics	**vol. %**	**D1319**	**± 1.5**	**15**	**40**	**40**	**15**	**40**	**15**	**15**	**15**	**40**	**40**
Olefins	vol. %	D1319	± 1.5	7	7	7	7	7	7	7	7	7	7
Benzene	vol. %	D3606	± 0.15	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
S	mg/kg	D5453	± 5	25	25	25	25	25	25	25	25	25	25
RON	-	D2699	± 2	93	93	93	93	93	93	93	93	93	93
MON	-	D2700	± 2	85	85	85	85	85	85	85	85	85	85
(R + M)/2	-	Calc.	± 2	89	89	89	89	89	89	89	89	89	89
C	mass %	Calc.	-	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
H	mass %	D4808 Method A	-	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
O	mass %	D5599	-	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Water Content	mg/kg	E1064	-	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Net Heat of Combustion	MJ/kg	D4809	-	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Oxidation Stability	minute	D525	-	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240
Copper Strip Corrosion, 3h at 122°F	-	D130	-	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1
Solvent-Washed Gum Content	mg/100 ml	D381	-	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5

Base Fuel Matrix (Cont'd)

TEST FUELS								
11	12	13	14	15	16	17	18	19
Report	Report	Report	Report	Report	Report	Report	Report	Report
Report	Report	Report	Report	Report	Report	Report	Report	Report
10	**10**	**0**	**10**	**0**	**10**	**0**	**9.5**	**14.5**
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.15
140	140	140	140	140	140	140	140	140
215	**215**	**235**	**235**	**235**	**235**	**215**	**202**	**195**
350	**350**	**300**	**300**	**350**	**350**	**325**	**325**	**325**
<437	<437	<437	<437	<437	<437	<437	<437	<437
6.65	**6.65**	**6.65**	**6.65**	**9.0**	**9.0**	**8.85**	**8.85**	**8.85**
40	**15**	**40**	**15**	**15**	**40**	**29.5**	**24.9**	**22.6**
7	7	7	7	7	7	7	7	7
0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
25	25	25	25	25	25	25	25	25
93	93	93	93	93	93	93	93	93
85	85	85	85	85	85	85	85	85
89	89	89	89	89	89	89	89	89
Report	Report	Report	Report	Report	Report	Report	Report	Report
Report	Report	Report	Report	Report	Report	Report	Report	Report
Report	Report	Report	Report	Report	Report	<0.1	Report	Report
Report	Report	Report	Report	Report	Report	Report	Report	Report
Report	Report	Report	Report	Report	Report	Report	Report	Report
>240	>240	>240	>240	>240	>240	>240	>240	>240
<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1
< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5

Vehicle Fleet Sizing

- Based on risk analysis
  - Same type of analysis was used in AutoOil Program
- Depends on assumed emissions difference which should be readily detectable as significant
- Requires estimates of the following parameters:
  - Test-to-test variability
  - Vehicle-to-vehicle variability among vehicles of the same model
- Internal EPA and OEM round robin lab correlation test data was used to determine fleet size
- Resultant EPACT Program fleet size: 19 vehicles

Vehicle Selection

- Based on MY engine family sales data
  - Usually multiple models to choose from for each engine family
  - High volume sellers are, by definition, representative, and should ease recruitment
- Data available for MY 04 – 06 Tier 2 vehicles
- All test vehicles must be Tier 2 (Bin 5 fleet average)
- All vehicles will be new and leased

Proposed Test Vehicles

Make	Year	Brand	Model	Engine	Family	T2 Bin
GM	2007	Chevrolet	Cobalt/HHR	2.4L I4	7GMXV02.4029	5
GM	2007	Chevrolet	Impala	3.5L V6	7GMXV03.5052	5
GM	2007	Buick/GMC/Saturn	Enclave/Acadia/Outlook	3.6L V6	7GMXT03.6151	5
GM	2007	Chevrolet/GMC	Avalanche	5.3L V8	7GMXT05.3381	4
Toyota	2007	Toyota	Corolla	1.8L I4	7TYXV01.8BEA	5
Toyota	2007	Toyota	Camry	2.4L I4	7TYXV02.4BEB	5
Toyota	2007	Toyota	Sienna	3.3L V6	7TYXT03.3BEM	5
Toyota	2007	Toyota	Tundra	4.0L V6	7TYXT04.0AEV	5
Ford	2007	Ford	Focus	2.0L I4	7FMXV02.0VD4	4
Ford	2007	Ford	500/new Taurus/Freestyle	3.0L V6	7FMXV03.0VED	5
Ford	2007	Ford/Mercury	Explorer/Mountaineer	4.0L V6	7FMXT04.03DB	4
Ford	2007	Ford	F150	5.4L V8	7FMXT05.44H2	8
Chrysler	2007	Dodge	Caliber	2.4L I4	7CRXB0144M80	5
Chrysler	2007	Dodge/Chrysler	Caravan/Town & Country	3.3L V6	7CRXT03.3NHP	8
Chrysler	2007	Jeep	Liberty	3.7L V6	7CRXT03.7NE0	5
Honda	2007	Honda	Civic	1.8L I4	7HNXV01.8MKR	5
Honda	2007	Honda	Accord	2.4L I4	7HNXV02.4KKC	5
Honda	2007	Honda	Odyssey	3.5L V6	7HNXT03.5VKR	5
Nissan	2007	Nissan	Altima	2.5L I4	7NSXV02.5G5A	5

Test Program

- Consists of three phases:
  - Phase 1: GHG Pilot at 75ºF
    - E0, E10, E15; 19 vehicles
  - Phase 2: GHG Pilot at 50ºF
    - E0, E10, E15; 19 vehicles
  - Phase 3: Main Program
    - 19 fuels, 19 vehicles
- California Unified Cycle (LA92) will be used throughout the program
- The order in which the various fuel/vehicle combinations are to be tested will be randomized
  - However, replicate tests will be done back-to-back
- The third replicate will be run if test-to-test ratio of NOx, HC or CO_2 results exceeds threshold value
  - Threshold values defined per methodology used in AutoOil program

Measured Parameters

- Bag (phase) level and composite emissions of THC, NMHC, NMOG, CO, CO_2, NOx, NO_2, ethanol and PM
- Bag (phase) level speciated volatile organic compounds (VOCs)
  - Over 200 compounds, incl. alcohols and carbonyls
- Continuous and integrated by bag (phase) emissions of the following species in raw exhaust:
  - THC, NMHC, CO, CO_2, NOx,
  - N_2O, NH_3 and HCN by FTIR for a subset of tests

Expanded EPAct Program

Expanded EPAct Program

- $0.9M has been made available to NREL from DOE's Biomass Program for use in expanding the EPAct Program
  - NREL has already received a funding letter from DOE for this amount
- Additional $1.1M is expected to become available shortly from DOE's Vehicle Technology Program
- Expanded fuel matrix consists of the following 29 fuels:
  - Base fuel matrix (16 + 3 fuels)
    - Includes the same fuels as Base EPAct Program
  - 9 additional E15 and E20 fuels and one E85 fuel per prior discussions with DOE
- DOE expressed interest in testing additional vehicles
- Lubrizol has committed to provide lubricant support for this program

Expanded EPAct Program (Cont'd)

- Further timeline and cost estimates assume the following:
  - 3 additional vehicles used in Phases 1, 2 and 3 of the program
  - Test program design similar to Base EPAct Program
    - Phase 1: GHG Pilot at 75ºF
      - E0, E10, E15; 22 vehicles
    - Phase 2: GHG Pilot at 50ºF
      - E0, E10, E15; 22 vehicles
    - Phase 3: Main Program
      - 25 fuels, 22 vehicles
    - One E85 fuel tested in four FFVs
  - Same parameters measured
- The add-on cost of the DOE component is estimated at $2.0M
- Expanded Program Timeline, w/o safety margin
  - Jan. 2008 – May 2008: Fuel blending
  - April 2008 – April 2009: Emissions testing
  - May 2009 – July 2009: Reporting

Expanded Fuel Matrix

Base Matrix (1-16) →

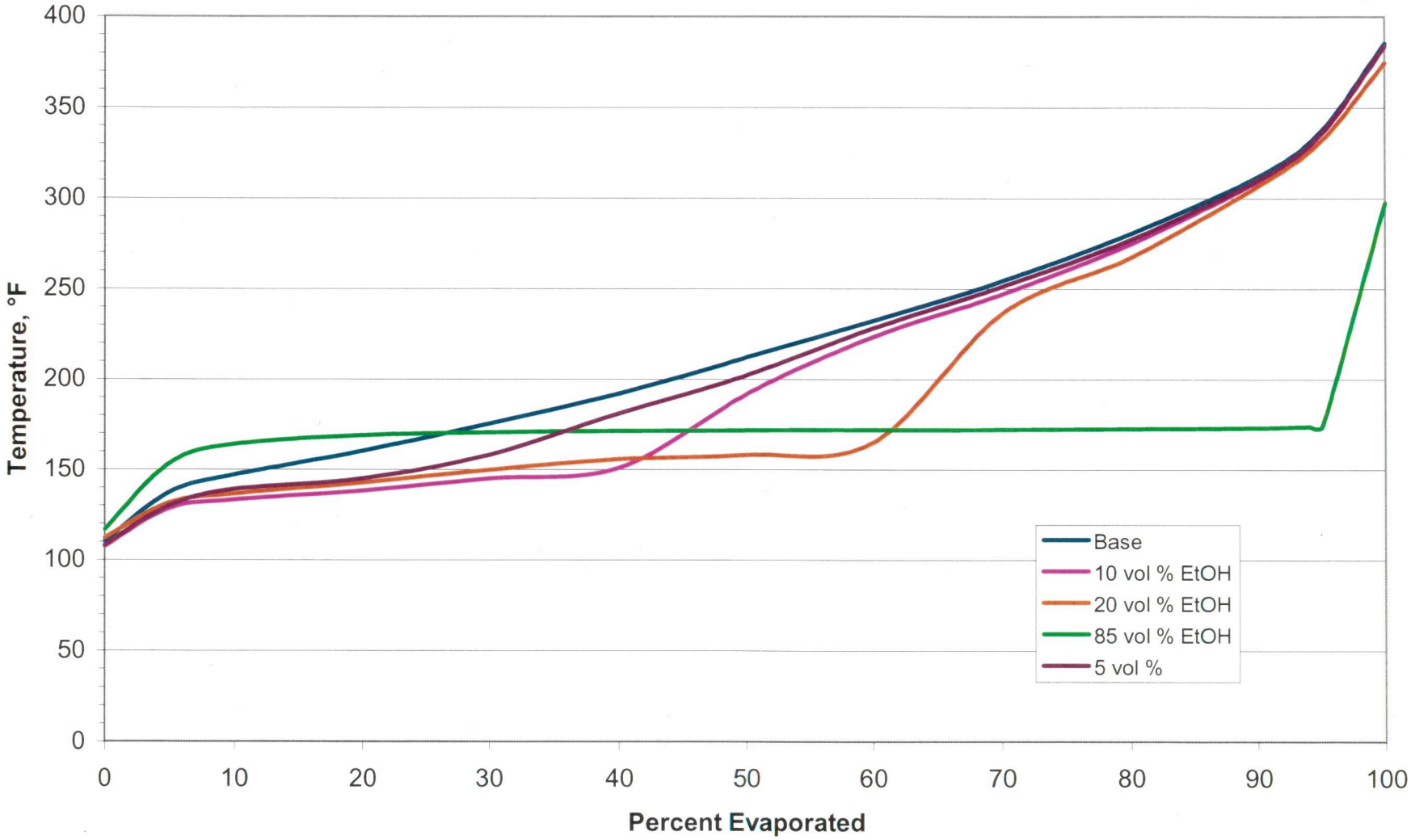
GHG Subset (17-19) →

DOE Fuels (20-29) →

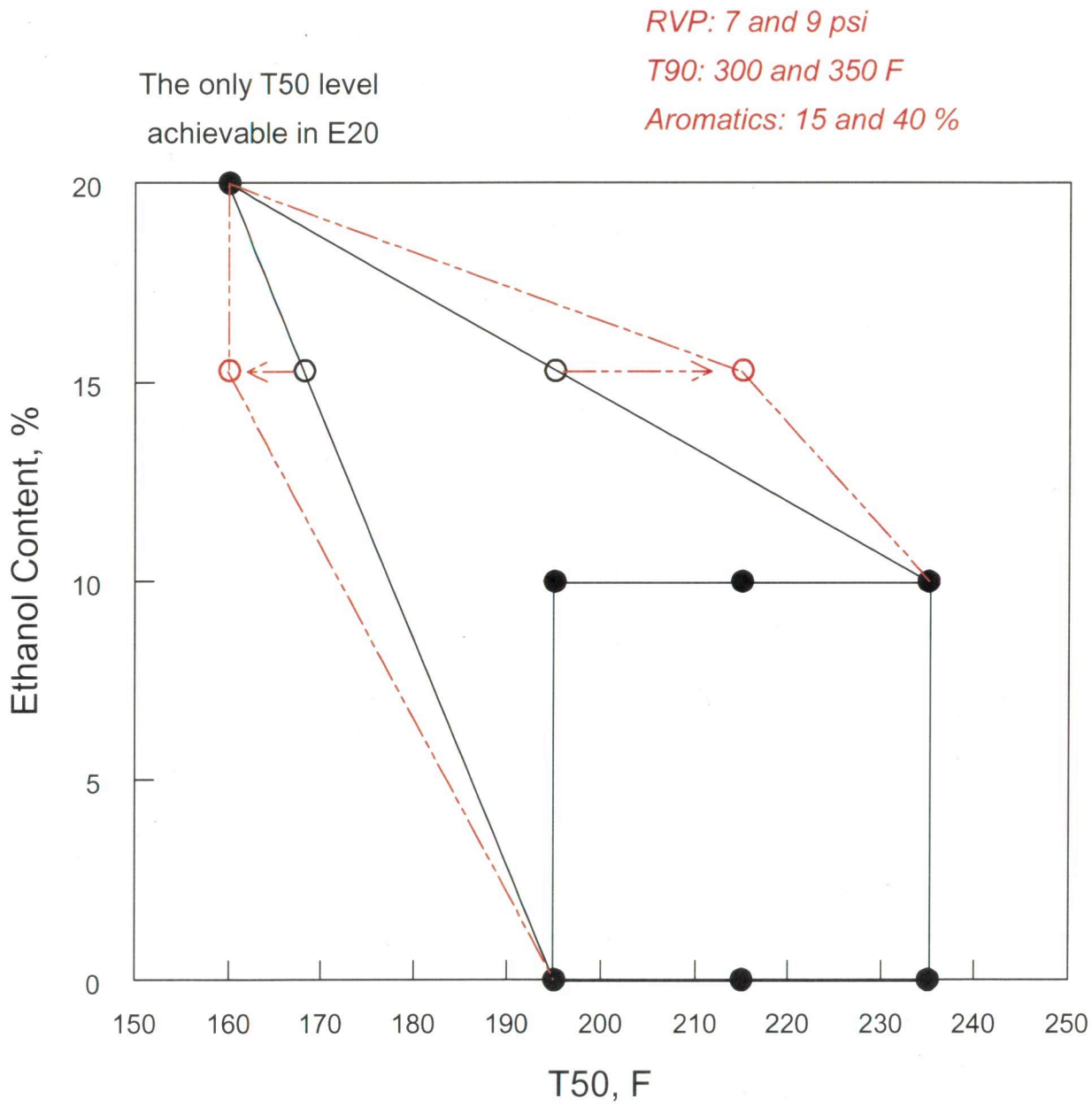
E85 →

Fuel #	T50 °F	T90 °F	ETOH %	RVP psi	ARO %
1	235	300	10	7	15
2	235	350	0	9	15
3	195	350	10	9	15
4	195	350	0	7	40
5	195	300	10	7	40
6	235	300	0	7	40
7	215	350	10	7	15
8	215	300	10	9	15
9	215	350	0	9	40
10	215	300	0	7	15
11	215	300	10	9	40
12	215	350	10	7	40
13	195	350	0	7	15
14	195	300	0	9	15
15	235	350	10	9	40
16	195	300	0	9	40
17	215	325	0	9	30
18	202	325	10	9	25
19	195	325	15	9	23
20	160	300	20	7	15
21	168.2	300	15.3	7	15
22	160	350	20	7	40
23	160	300	20	9	40
24	160	350	20	9	15
25	195	300	15.3	7	15
26	168.2	350	15.3	9	40
27	195	350	15.3	9	40
28	160	350	20	9	40
29	TBD	TBD	85	TBD	TBD

Effect of Ethanol Addition on the D 86 Distillation Curve



Source: Chevron


RVP: 7 and 9 psi
T90: 300 and 350 F
Aromatics: 15 and 40 %
The only T50 level
achievable in E20
Ethanol Content, %
20
15
10
5
0
150
160
170
180
190
200
210
220
230
240
250
T50, F

Main (Phase 3) Fuel Matrix

- Computer generated optimal design
- Fuel variables:
  - T50 (3 levels)
  - T90 (2 levels)
  - EtOH (4 levels)
  - RVP (2 levels)
  - Aromatics (2 levels)
- Terms in model: Main effects, $EtOH^2$, $T50^2$, T50*EtOH, T90*EtOH, RVP*EtOH, aromatics* EtOH
- Number of test fuels: 25
- G-Efficiency: 70.1%
- T50 range of E15 fuels must be confirmed by Halterman

Base Fuel Matrix (Cont'd)

PROPERTY	UNIT	METHOD	BLENDING TOLERANCE	TEST FUELS									
				1	2	3	4	5	6	7	8	9	10
Relative Density, 60/60°F	-	D4052	NA	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
API Gravity, 60°F	°API	D4052	NA	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Ethanol Content	**vol. %**	**D5599**	**E0: < 0.1; E10: ± 0.5; E15: ± 0.5; E20: ±0.5; E85: ±2**	**0**	**0**	**10**	**0**	**0**	**10**	**0**	**10**	**10**	**0**
Total Content of Oxygenates Other than Ethanol	vol. %	D5599	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
T10	°F	D86	± 10	140	140	140	140	140	140	140	140	140	140
T50	**°F**	**D86**	**± 4**	**195**	**195**	**195**	**195**	**195**	**195**	**215**	**215**	**215**	**215**
T90	**°F**	**D86**	**± 5**	**300**	**300**	**300**	**350**	**350**	**350**	**300**	**300**	**300**	**350**
FBP	°F	D86	-	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437
DVPE	**psi**	**D5191**	**± 0.15**	**9.0**	**9.0**	**6.65**	**6.65**	**6.65**	**9.0**	**6.65**	**9.0**	**9.0**	**9.0**
Aromatics	**vol. %**	**D1319**	**± 1.5**	**15**	**40**	**40**	**15**	**40**	**15**	**15**	**15**	**40**	**40**
Olefins	vol. %	D1319	± 1.5	7	7	7	7	7	7	7	7	7	7
Benzene	vol. %	D3606	± 0.15	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
S	mg/kg	D5453	± 5	25	25	25	25	25	25	25	25	25	25
RON	-	D2699	± 2	93	93	93	93	93	93	93	93	93	93
MON	-	D2700	± 2	85	85	85	85	85	85	85	85	85	85
(R + M)/2	-	Calc.	± 2	89	89	89	89	89	89	89	89	89	89
C	mass %	Calc.	-	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
H	mass %	D4808 Method A	-	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
O	mass %	D5599	-	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Water Content	mg/kg	E1064	-	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Net Heat of Combustion	MJ/kg	D4809	-	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Oxidation Stability	minute	D525	-	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240
Copper Strip Corrosion, 3h at 122°F	-	D130	-	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1
Solvent-Washed Gum Content	mg/100 ml	D381	-	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5

Base Fuel Matrix (Cont'd)

TEST FUELS																		
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29*
Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
10	**10**	**0**	**10**	**0**	**10**	**0**	**9.5**	**14.5**	**20**	**15.3**	**20**	**20**	**20**	**15.3**	**15.3**	**15.3**	**20**	**81**
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.15	<0.2	<0.15	<0.2	<0.2	<0.2	<0.15	<0.15	<0.15	<0.2	<2.0
140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	-
215	**215**	**235**	**235**	**235**	**235**	**215**	**202**	**195**	**160**	**168**	**160**	**160**	**160**	**195**	**168**	**195**	**160**	-
350	**350**	**300**	**300**	**350**	**350**	**325**	**325**	**325**	**300**	**300**	**350**	**300**	**350**	**300**	**350**	**350**	**350**	-
<437	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437	-
6.65	**6.65**	**6.65**	**6.65**	**9.0**	**9.0**	**8.85**	**8.85**	**8.85**	**6.65**	**6.65**	**6.65**	**9.0**	**9.0**	**6.65**	**9.0**	**9.0**	**9.0**	**6.85**
40	**15**	**40**	**15**	**15**	**40**	**29.5**	**24.9**	**22.6**	**15**	**15**	**40**	**40**	**15**	**15**	**40**	**40**	**40**	Report
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	Report
0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	Report
25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	15
93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	Report
85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	Report
89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	Report
Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Report	Report	Report	Report	Report	Report	<0.1	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	<10,000
Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
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< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5

Timeline of Expanded EPAct Program

Phase	# of Emission Tests	# of Weeks	Duration	
			From	To
Fuel blending	-	22	2-Jan	31-May
Phase 1 (75°F)	135	5	1-Apr	6-May
50°F Switchover	-	2	7-May	20-May
Phase 2 (50°F)	135	7.5	21-May	11-Jul
Phase 3 (75°F)	1128	41.8	14-Jul	30-Apr-09
Reporting	-	12	1-May-09	31-Jul-09

No margin of safety !!!

Program Cost

5 U.S.C. § 552(b)(5) Deliberative / Non-Responsive

- Calculations assume 2.05 replicates per each fuel/vehicle combination

Next Steps

- Finalize the design of the expanded EPAct Program
- Define options to pursue in case additional funds become available
- Coordinate with SWRI and Halterman to make sure that test fuels are blended on time
- Coordinate with SWRI to make sure that the test program is launched on time and each of its three phases completed according to schedule
- Set up a joint EPA/NREL program oversight system to ensure that test data generated is of required quality